

**Application No.: 10/574,863**

**REMARKS**

As a preliminary matter, it is noted that the Examiner has not initialed several prior art references listed in the IDS filed on July 28, 2009 because copies of said references were allegedly not provided. However, it is respectfully submitted that copies of said references were properly submitted to the USPTO as evidenced by the attached pages from PAIR.

In addition, upon review of the record, it is further noted that the three Japanese prior art references (JP '053, '867, '462) listed in the IDS filed April 6, 2006, as well as a technical publication ("Mizuno, B., "Ultra Shallow Junction for sub-50NM CMOS") and two US patent applications '572, '567) listed in the IDS filed March 28, 2008, also have not been initialed.

It is respectfully requested that the Examiner provide Applicants an initialed copy of the aforementioned IDS's indicating that each of the prior art references cited therein have been considered and made of record.

Claim 31 is independent and stands rejected under 35 U.S.C. § 103 as being unpatentable over Maydan et al. '612 ("Maydan") in view of Yang '699 ("Yang") and Downey et al. '281 ("Downey"). This rejection is respectfully traversed for the following reasons.

Claim 31 recites in pertinent part, "forming an *amorphous* layer at a shallow region in a *silicon substrate* by irradiating a plasma containing He..." (emphasis added). The Examiner admits that Maydan does not disclose using He as the particular gas for forming an amorphous layer. The Examiner therefore relies on Yang as allegedly obviating this admitted deficiency of Maydan.

However, Yang discloses only using He as an inert element for forming an amorphous layer of a *polysilicon*, not the crystalline substrate of Maydan. Accordingly, even assuming

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*arguendo* the teachings of Maydan and Yang can be properly combined, such a combination does not suggest forming an amorphous layer using He in specifically a silicon substrate. That is, Yang merely discloses a conventional process of forming an amorphous layer from a *polysilicon*. As would be recognized by one of ordinary skill in the art, an amorphous layer can be easily formed from a polysilicon using any elements (He or otherwise).

On the other hand, according to one aspect of the present invention, the claimed combination can make it possible to form an amorphous film from a hard single crystal substrate. In this regard, the element used for forming the amorphous film can be He which is relatively light (e.g., one-tenth of Ar). It is respectfully submitted that, at the time of invention, forming an amorphous film from a hard single crystal substrate using the relatively light He was not enabled by conventional technology.

Indeed, there is a technical leap for one of ordinary skill in the art to, *using the relatively light element He*, go from forming amorphous layers from polysilicon to forming amorphous layers from hard single crystal substrates. In this regard, He is relatively a very small and light element as compared to Si, Ge, Ar, Ne, Kr, etc.. In sum, one of ordinary skill in the art would not have considered, much less conceived of a viable manner to achieve, forming an amorphous layer from a hard single crystal substrate using specifically He with the known technology at the time of invention.

Accordingly, at the time of invention, it is respectfully submitted that at best the cited prior art disclosed only forming amorphous layers of silicon substrates using relatively heavy elements Xe, Ar (Maydan), or forming amorphous layers of polysilicon using any elements (Yang). In this regard, the teaching of Yang is not applicable to Maydan in that the cited prior art does not enable forming an amorphous layer of the hard crystal silicon substrate of Maydan

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using the light, small element of He taught in Yang. None of the cited prior art suggests, *nor enables*, forming an amorphous layer of specifically a hard silicon substrate using specifically a light element such as He. Only Applicants have conceived of a viable manner in which such a *combination* (light element He used to form amorphous layer of hard silicon substrate) can be enabled.

Indeed, only Applicants recognized a reason to conceive such a combination. Specifically, as described throughout Applicants' specification, the high coefficient of diffusion and chemical stability of He enables only a small amount of He to possibly remain in the surface after annealing; whereas, elements other than He and H, even if the annealing is done after the impurity is diffused, would remain in the crystal.

Further, elements such as Ar, Si, Ge other than He and H have a large atomic radius so as to cut the surface in plasma doping. In contrast, as He and H are relatively light atoms, the present invention enables forming the amorphous layer of the single crystal without cutting the surface.

In this regard, claim 1 further recites in pertinent part, "introducing boron by applying a plasma to the shallow region of the silicon substrate; and applying light having an intensity peak at a wavelength of 375nm or longer on the silicon substrate so that said shallow region is excited selectively and the shallow junction is formed electrically activated with the boron." The Examiner admits that Maydan does not disclose the aforementioned feature, and therefore relies on Downey as allegedly obviating this admitted deficiency of Maydan.

Even assuming *arguendo* Yang suggested modifying the He co-implantation of Maydan so that the He itself formed the amorphous layer, the broad activation annealing parameters taught by Downey would teach away from the claimed combination. Specifically, the annealing

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of Downey when configured for effecting a rapid temperature increase of the substrate surface would cause the He to leap explosively outwardly from the Si substrate, thereby potentially roughening the surface of the Si substrate so as to damage the MOSFET by which it would not function normally (increased level of defectiveness). In this regard, accordingly, the cited prior art teaches away from using the activation annealing process of Downey in combination with a He-effected amorphous layer specifically in a silicon substrate.

"All words in a claim must be considered in judging the patentability of that claim against the prior art." *In re Wilson*, 165 USPQ 494, 496 (CCPA 1970).

Under Federal Circuit guidelines, a dependent claim is nonobvious if the independent claim upon which it depends is allowable because all the limitations of the independent claim are contained in the dependent claims, *Hartness International Inc. v. Simplimatic Engineering Co.*, 819 F.2d at 1100, 1108 (Fed. Cir. 1987). Accordingly, as claim 31 is patentable for the reasons set forth above, it is respectfully submitted that all claims dependent thereon are also patentable. In addition, it is respectfully submitted that the dependent claims are patentable based on their own merits by adding novel and non-obvious features to the combination.

Based on the foregoing, it is respectfully submitted that all pending claims are patentable over the cited prior art. Accordingly, it is respectfully requested that the rejections under 35 U.S.C. § 103 be withdrawn.

### CONCLUSION

Having fully responded to all matters raised in the Office Action, Applicants submit that all claims are in condition for allowance, an indication for which is respectfully solicited. If there are any outstanding issues that might be resolved by an interview or an Examiner's

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amendment, the Examiner is requested to call Applicants' attorney at the telephone number shown below.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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Method for making junction and processed material formed using the same

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